Bossier Parish Community College
Master Syllabus

**Course Prefix and Number**: SONO 216 **Credit hours**: 1

**Course Title**: Physics and Instrumentation III

**Course Prerequisites:** Enrollment in the DMS program courses is limited to those students who have been selected and admitted to the professional phase of the program. Program courses are sequenced by semester and must be taken as a group each semester per program requirements and policies. Completion of SONO 210

**Textbook(s):**
**Required Textbooks:** Understanding Ultrasound Physics: Sidney Edelman 4th edition

Sonography Exam Review: Susanna Ovel 3rd edition

## Course Description:

Lectures and related demonstrations covering advanced Doppler physics and implementation. Comprehensive review of all sonographic physics and instrumentation, vascular physics, and hemodynamics of blood vessels.

## Learning Outcomes:

**A. Demonstrate knowledge and application of image production and optimization.**

1) Sound production and propagation
2) Interaction of sound and matter
3) Instrument options and transducer selection
4) Principles of ultrasound instruments and modes of operation
5) Operator control options
6) Physics of Doppler
7) Principles of Doppler techniques
8) Methods of Doppler flow analysis
9) Hemodynamics of blood flow
10) Contrast-enhanced imaging
11) Acoustic artifacts
12) Emerging technologies
13) Image storage devices

**B. Demonstrate knowledge and application of biological effects.**

1) In-vitro and in-vivo ultrasound effects
2) Exposure/equipment display indices
3) Generally accepted maximum safe exposure levels
4) ALARA principle
    a) Mechanisms that affect the mechanical and thermal indices

b) Techniques to decrease the mechanical and thermal indices

**C. Demonstrate knowledge of a quality control and improvement program.**

1) Lab accreditation
2) Credentialing organizations
3) Equipment operation and maintenance
    a) Phantom testing
    b) Records maintenance

**To achieve the learning outcomes, the student will or will be able to:**

- List and compare the various kinds of flow encountered in blood circulation.
- Explain how a stenosis affects flow.
- Define and discuss the Doppler effect, the Doppler shift, and the Doppler angle.
- Explain how two-dimensional flow information is color-encoded on a sonographic display.
- Compare Doppler-shift with Doppler-power color displays.
- Explain how flow detection is localized to a specific site in tissue by using pulsed Doppler techniques.
- Describe spectral analysis.
- Discuss examples of how spectral analysis is applied to evaluate flow conditions at the site of measurement and proximal and distal to it.
- List reasons for incorrect presentation of anatomic structures on sonographic gray-scale images.
- List reasons for incorrect presentation of motion and flow information on spectral and color-Doppler displays.
- Describe sound wave characteristics using the seven parameters: period, frequency, amplitude, power, intensity, wavelength, and speed
- Describe pulsed sound using the parameters: pulse duration, pulse repetition frequency, duty factor, pulse repetition period, and spatial pulse length.
- Discuss the acoustic variables; pressure, density, and distance and their role in ultrasound
- Explain the pulse-echo principle used in sonographic imaging.
- Describe the image formats used in sonography.
- Explain the concept of frequency and its importance in sonography.
- Define ultrasound and describe its behavior.
- Compare continuous with pulsed ultrasound.
- Describe the weakening of ultrasound while it travels through tissue.
- Discuss the generation of echoes in tissue.
- Describe the construction of a transducer and the function of each part.
- Explain how a transducer generates ultrasound pulses.
- Explain how a transducer receives echoes.
- Describe a sound beam and list the factors that affect it.
- Discuss how sound beams are focused and automatically scanned through anatomy.

- Compare linear, convex, phased, and vector arrays.
- Define detail resolution.
- Differentiate among the three aspects of detail resolution.
- List the factors that determine detail resolution.
- Explain how sonographic instruments work.
- List the primary components of sonographic instruments.
- List the functions of each component.
- Describe how images are stored electronically.
- Compare preprocessing with postprocessing.
- Compare signal processing and image processing.
- Explain how displays work.
- List the common display modes.
- Define contrast resolution and list the factors that influence it.
- Define temporal resolution and list the factors that influence it.
- List the functions of the beam former.
- List the functions of the image former.
- Discuss the purposes of coded excitation, gain, compensation, detection, and compression.
- Explain how an operator of an ultrasound instrument can implement the ALARA principle by minimizing exposure of the patient to ultrasound during diagnostic scanning.
- List and compare the various kinds of flow encountered in blood circulation.
- Explain how a stenosis affects flow.
- Explain how the Doppler effect is applied in sonography.
- List the ways in which Doppler information is presented.
- Define and discuss the Doppler effect, the Doppler shift, and the Doppler angle.
- Explain how two-dimensional flow information is color-encoded on a sonographic display.
- Compare Doppler-shift with Doppler-power color displays.
- Explain how flow detection is localized to a specific site in tissue by using pulsed Doppler techniques.
- Describe spectral analysis.
- Discuss examples of how spectral analysis is applied to evaluate flow conditions at the site of measurement and proximal and distal to it.
- List reasons for incorrect presentation of anatomic structures on sonographic gray-scale images.
- List reasons for incorrect presentation of motion and flow information on spectral and color-Doppler displays.
- Describe how specific artifacts can be recognized.
- Explain how to avoid the pitfalls and misdiagnoses artifacts can cause.
- Explain how to determine whether a sonographic or Doppler instrument is working

properly.
- List the devices that are available to test various performance characteristics of instruments.
- Compare a test object with a phantom.
- Describe how instrument output is measured.

**Course Requirements**: **In order to pass the course, the student must earn 76% of the total possible points on the unit tests for the course and make a minimum score of 70% on the final exam. The student must achieve an overall course average of 76%. Grades will not be rounded. Failure to complete any of the course requirements listed below will result in an "F" for the course.**

The student will:
- Participate in/complete all classroom/laboratory experiences (such as discussion questions; quizzes; section test; case studies; concept mapping; DVD, video, web-site, or reading assignments).
- Be held responsible for the content of the entire course. The final exam is mandatory, will be cumulative, and worth 25% of the overall grade for the course.

**Course Grading Scale**:

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| 93 – | 100%= | A |
| 85 – | 92%= | B |
| 76 – | 84%= | C |
| 68 – | 75%= | D |
| 0 – | 67%= | F |

**Attendance Policy**: The college attendance policy (for the classroom) is available at http://catalog.bpcc.edu/content.php?catoid=5&navoid=369#class-attendance

**Course Fees**: (if applicable)

**Nondiscrimination Statement**

Bossier Parish Community College does not discriminate on the basis of race, color, national origin, gender, age, religion, qualified disability, marital status, veteran's status, or sexual orientation in admission to its programs, services, or activities, in access to them, in treatment of individuals, or in any aspect of its operations. Bossier Parish Community College does not discriminate in its hiring or employment practices.

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